CLAIMS

What is claimed is:

1. An electrochemical cell comprising a curable protonic polymer based electrolyte composition, wherein the electrolyte composition comprises:

   a. between 10 wt% and 50 wt% of the protonic polymer comprising acidic groups for transporting protons;

   b. between 10 wt% and 89 wt% of a monomer for dissolving the protonic polymer;

   c. between 1 wt% and 60 wt% of a cross linking agent having at least two vinyl functionalities; and

   d. wherein upon combining the protonic polymer, monomer and cross linking agent, a curable electrolyte solution is formed with at least 50 wt% of the above components based on the total weight percent of the formed solution.

2. The electrochemical cell of claim 1, further comprising a quantity of initiator sufficient to cure the composition when using a procedure comprising of photo-curing, thermal curing and combinations thereof.

3. The electrochemical cell of claim 1, wherein the protonic polymer comprises acid groups.

4. The electrochemical cell of claim 1, wherein the monomer is a vinyl monomer bearing an acidic group.

5. The electrochemical cell of claim 4, wherein the acidic group comprises a sulfonic acid group, a phosphonic acid group, a carboxylic acid group, and combinations thereof.

6. The electrochemical cell of claim 1, wherein the cross-linking agent vinyl functionalities are divinyl derivatives of an organic compound.

7. The electrochemical cell of claim 6, wherein the organic compound is selected from the group consisting of an aliphatic, an aromatic, a heteroaromatic and combinations thereof.

8. The electrochemical cell of claim 6, wherein the organic compound is selected from the group consisting of sulfonic acid, sulfones, phosphates, phosphones, phosphonic acid, carboxylates, carboxylic acid, acrylates, methylacrylates, acrylamides, methacrylamides, and combinations thereof.

9. The electrochemical cell of claim 1, wherein the cross linking agent vinyl functionality is a trivinyl derivative of an organic compound.

10. The electrochemical cell of claim 9, wherein the organic compound is selected from the group consisting of sulfonic acid, sulfones, phosphates, phosphones, phosphonic acid, carboxylates, carboxylic acid, acrylates, methylacrylates, acrylamides, methacrylamides, and combinations thereof.

11. The electrochemical cell of claim 1, wherein the curable liquid electrolyte solution further comprises an elastising agent.

12. The electrochemical cell of claim 1, wherein the elasticizing agent is a polymerizable vinyl monomer to enhance the toughness of structure of the cured electrolyte.

13. The electrochemical cell of claim 1, consisting of:

a. between 20 wt% and 40 wt% of a protonic polymer comprising acidic groups for transporting protons;

b. between 20 wt% and 70 wt% of a monomer for dissolving the protonic polymer; and

c. between 5 wt% and 50 wt% of a cross linking agent having at least two vinyl functionalities.

14. A fuel cell with a curable electrolyte, wherein the curable electrolyte comprises:

a. between 10 wt% and 50 wt% of a protonic polymer comprising acidic groups for transporting protons;

b. between 10 wt% and 89 wt% of a polar monomer;

c. a polar solvent for dissolving the polar monomer;

d. between 1 wt% and 60 wt% of a cross linking agent having at least two vinyl functionalities; and

e. wherein upon wherein upon combining the protonic polymer, polar vinyl monomer, polar solvent, and cross linking agent, a curable electrolyte solution is formed with at least 50 wt% of the above components based on the total weight percent of the formed solution.

15. The fuel cell of claim 14, wherein the polar solvent is water.

16. The fuel cell of claim 14, wherein the polar solvent is organic.

17. The fuel cell of claim 14, wherein the polar solvent comprises dimethylformamide, dimethylacetamide, n-methylpyrrolidinone and combinations thereof.

18. The fuel cell of claim 14, wherein the polar monomer is a vinyl monomer bearing an acidic group.

19. The fuel cell of claim 18, wherein the acidic group comprises a sulfonic acid group, a phosphonic acid group, a carboxylic acid group and combinations thereof.

20. The fuel cell of claim 14, wherein the cross linking agent is a divinyl derivative of an organic compound.

21. The fuel cell of claim 20, wherein the organic compound comprises an aliphatic, an aromatic, a heteroaromatic, and combinations thereof.

22. The fuel cell of claim 20, wherein the organic compound comprises a sulfonic acid, a sulfone, a phosphate, a phosphone, a phosphonic acid, a carboxylate, a carboxylic acid, an acrylate, a methylacrylate, an acrylamide, a methacrylamide, and combinations thereof.

23. The fuel cell of claim 14, wherein the cross linking agent is a trivinyl derivative of an organic compound.

24. The fuel cell of claim 23, wherein the organic compound comprises sulfonic acid, phosphates, phonsphonic acid, carboxylates, carboxylic acid, acrylates, methylacrylates, acrylamides, methacrylamides, and combinations thereof.

25. The fuel cell of claim 14, wherein the protonic polymer comprises sulfonic acid, carboxylic acid, and combinations thereof.

26. The fuel cell of claim 14, further comprising an elasticizing agent.

27. The fuel cell of claim 26, wherein the elasticizing agent is a polymerizable vinyl monomer to enhance the toughness of structure of the cured electrolyte.

28. The fuel cell of claim 14, further comprising an initiator usable when the electrolyte is cured by photo-curing, thermal curing, and combinations of thereof.

29. A method for producing a curable liquid electrolyte for an electrochemical cell comprising the steps of:

a. mixing a protonic polymer solution with a solvent comprising a monomer and a cross linking agent forming a mixture, wherein the cross linking comprises at least two vinyl functionalities;

b. removing the solvent from the mixture by distillation to obtain a curable protonic polymer electrolyte;

c. disposing the curable protonic polymer electrolyte on a substrate forming an intermediate; and

d. treating the intermediate to form a cured electrolyte with increased viscosity and increased structural strength.

30. The method of claim 29, further comprising the step of adding an initiator to the mixture and treating the intermediate with a procedure selected from the group consisting of photo-curing, thermal curing and combinations thereof.

31. The method of claim 29, wherein the treating of the intermediate is by electron bombardment.

32. The method of claim 29, further comprising the step of adding a solvent to the mixture.

33. The method of claim 29, further comprising the step of adding an elastising agent to the mixture.

34. The method of claim 33, wherein the elasticizing agent is a polymerizable vinyl monomer to enhance the toughness of structure of the cured protonic polymer electrolyte.